



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
ONE DENVER PLACE — 999 18TH STREET — SUITE 1300
DENVER, COLORADO 80202-2413

REF: 8WM-DW

Mr. Alvin W. Simpson
Manager, Production Department
Murphy Oil USA, Incorporated
200 Peach Street
El Dorado, Arkansas 71730

RECEIVED
NOV 17 1986
LAND AND MINERALS

ROUTE	Init.	Date
_____ Natural Resources Officer	<i>WSP</i>	<i>11/7</i>
_____ Range Conservationist	_____	_____
_____ Soil Conservationist	_____	_____
_____ Geologist	_____	_____
<input checked="" type="checkbox"/> Petroleum Engineer	_____	_____
_____ Natural Resources Spec.	_____	_____
_____ Archeologist	_____	_____
_____	_____	_____

RE: UNDERGROUND INJECTION CONTROL (UIC)
Draft Permit for Courchene No. 1-D
EPA Permit #MTS2301-0611
Roosevelt County, Montana

Dear Mr. Simpson:

Enclosed is a draft Underground Injection Control Permit for the injection well, Courchene No. 1-D, in Roosevelt County, Montana. A Statement of Basis, which discusses development of the permit, is enclosed.

A notice should appear soon in the Billings Gazette notifying the public of their opportunity to comment. A notice of our intent to issue a permit has also been sent to any surface landowners who may be affected by the proposed actions.

The public comment period on these actions will run for thirty (30) days from the date of publication. You may call Ms. Edna Walton at (303) 293-1421 to obtain the exact deadline for public comments.

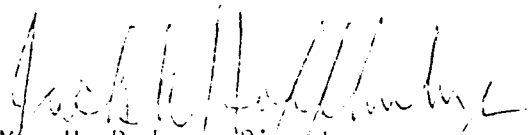
Please be aware that a final permit decision will not be made until after the public comment period closes. This draft permit does not constitute a final decision, however, you may continue to operate the well under authorization by rule until a final decision is made.

Before a final permit decision will be made, all public comments will be taken into consideration. If any substantial comments are received or if any substantial changes are made from the draft permit to the final permit, it will be necessary to delay the effective date of the final permit action for an additional thirty (30) days. This delay is required by Section 124.15(b) in order to allow for a potential appeal of the final decision.

Mr. Alvin W. Simpson
Murphy Oil USA, Incorporated
Page 2

If you have any questions on this action, please call Marc Herman at
(303) 293-1422.

Sincerely,



Max H. Dodson, Director
Water Management Division

Enclosure: Draft Permit
Statement of Basis
Public Notice



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
ONE DENVER PLACE — 999 18TH STREET — SUITE 1300
DENVER, COLORADO 80202-2413

PUBLIC NOTICE
INTENT TO ISSUE AN UNDERGROUND INJECTION CONTROL PERMIT
TO
MURPHY OIL USA, INCORPORATED

PURPOSE OF PUBLIC NOTICE

The purpose of this notice is to solicit public comment on the proposal by the Region VIII Office of the U. S. Environmental Protection Agency (EPA) to issue a permit to inject fluids underground via a Class II salt water disposal injection well.

BACKGROUND

EPA Region VIII is currently reviewing an application for an Underground Injection Control Permit from Murphy Oil USA, Incorporated, 200 Peach Street, El Dorado, Arkansas 71730, regarding produced water disposal operations. The injection fluid is salt water produced in conjunction with the extraction of oil from the Nisku and Madison Formations. Murphy Oil has proposed to inject fluids into the Judith River Formation, through an injection well, the Courchene No. 1-D, located in the SW 1/4 of Section 4, T30N, R46E, Roosevelt County, Montana.

EPA has made a preliminary determination to approve the permit application and that by doing so, any underground sources of drinking water will be protected. Therefore, EPA is hereby serving notice of intent to issue a permit, for the proposed underground injection activities, to Murphy Oil USA, Incorporated.

PUBLIC COMMENTS

All data submitted by the applicant, as well as the draft permit prepared by EPA, are contained in the administrative record for Murphy Oil. This information is available for public inspection at these locations from 9:00 a.m. to 5:00 p.m., or by contacting one of the following offices:

Environmental Protection Agency
Region VIII
Ground Water Section
Attn: Marc Herman
One Denver Place, Suite 1300
999 18th Street
Denver, Colorado 80202-2413
Telephone (303) 293-1422

Environmental Protection Agency
Montana Office
Federal Office Building
Drawer 10096
301 South Park
Helena, Montana 59626
Telephone (406) 449-5414

Public comments are encouraged and will be accepted, in writing, at the Denver Office for a period of thirty (30) days after publication of this notice. A request for a public hearing should be made in writing and should state the nature of the issues proposed to be raised at the hearing. A PUBLIC HEARING WILL BE HELD ONLY IF SIGNIFICANT INTEREST IS SHOWN.

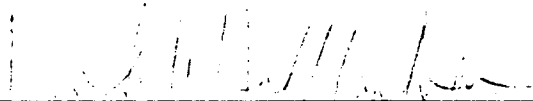
FINAL PERMIT DECISION AND APPEAL PROCESS

After the close of the public comment period, EPA will issue a final permit decision, and will notify all commenters regarding this decision. The final decision may be to: issue; deny; modify; or revoke and reissue the draft permit. The final decision shall become effective thirty (30) days after the final decision is issued, unless no commenters requested a change in the draft permit, in which case the permit shall become effective immediately upon issuance.

Within thirty (30) days after a final permit decision has been issued, any person who filed comments on the draft permit or participated in a public hearing, may petition the Administrator to review the permit decision. Commenters are referred to 40 CFR Sections 124.15 through 124.20 for procedural requirements of the appeal process.

NOV 12 1986

Date of Publication



Max H. Dodson, Director
Water Management Division



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
ONE DENVER PLACE — 999 18TH STREET — SUITE 1300
DENVER, COLORADO 80202-2413

UNDERGROUND INJECTION CONTROL PROGRAM

Draft Permit

Class II Salt Water Disposal Well

Permit # MTS2301-0611

Well Name: Courchene No. 1-D

Field Name: Volt

County & State: Roosevelt County, Montana

issued to:

Murphy Oil USA, Incorporated
200 Peach Street
El Dorado, Arkansas 71730

Date Prepared: October 28, 1986

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PART I. AUTHORIZATION TO INJECT

Pursuant to the Underground Injection Control Regulations of the U. S. Environmental Protection Agency codified at Title 40 of the Code of Federal Regulations, Parts 124, 144, 146, and 147,

Murphy Oil USA, Incorporated
200 Peach Street
El Dorado, Arkansas 71730

is hereby authorized to operate the Class II injection well, commonly known as Courchene No. 1-D, located in the SW 1/4, 801 feet from the south line and 2034 feet from the west line of Section 4, Township 30 North, Range 46 East in Roosevelt County, Montana. Injection shall be for the purpose of disposing of produced water from the Nisku and Madison Formations, in accordance with conditions set forth herein.

This document serves as authorization to begin injection activities and also serves as a permit for the well. "Transition from Rule to Permit Authorization" requirements are set forth in Part II, Section C. 1. of this permit.

All conditions set forth herein refer to Title 40 Parts 124, 144, 146, and 147 of the Code of Federal Regulations and are regulations that are in effect on the date that this permit becomes effective.

This permit consists of a total of 27 pages and includes all items listed in the Table of Contents. Further, it is based upon representations made by the permittee and on other information contained in the administrative record.

This permit and the authorization to inject are issued for the operating life of the well, unless terminated. The permit will be reviewed by EPA at least every five years to determine whether action under 40 CFR 144.36 (a) is warranted. The permit will expire upon delegation of primary enforcement responsibility for the UIC Program to the State of Montana, unless that State both has adequate authority, and chooses, to adopt and enforce this permit as a State permit.

Issued this _____ day of _____, 1986.

This permit shall become effective _____.

* _____
Max H. Dodson, Director
Water Management Division

* NOTE: The person holding this title is referred to as the "Director" throughout this permit.

PART II. SPECIFIC PERMIT CONDITIONS

A. WELL CONSTRUCTION REQUIREMENTS

1. Casing and Cementing. Existing construction details submitted with the application are hereby incorporated into this permit as Appendix A. A narrative description of the well construction is included with the well schematic.

2. Tubing and Packer Specifications. A tubing of two and seven-eighths (2 and 7/8) inches diameter is to be utilized and is cemented in place as described in Appendix A.

3. Monitoring Devices. The operator shall provide and maintain in good operating condition:

- (a) taps on each line between each tank battery and the disposal well, for the purposes of obtaining representative samples of the injection fluids;
- (b) one, one-half (1/2) inch Female Iron Pipe (FIP) fitting, isolated by plug or globe valve, and located at the well head on the tubing and positioned to allow attachment of a 1/2 inch Male Iron Pipe (MIP) gauge;
- (c) a flow meter with cumulative volume recorder that is certified for at least five (5) percent accuracy throughout the range of injection rates allowed by the permit.

4. Proposed Changes and Workovers. The permittee shall give advance notice to the Director, as soon as possible, of any planned physical alterations or additions to the permitted facility. In addition, the permittee shall provide all records of well workovers, logging, or other test data to EPA within sixty (60) days of completion of the activity. Appendix B contains samples of the appropriate reporting forms.

5. Formation Testing. The permittee is not required to perform any logging or other formation tests on the injection well before the effective date of this permit.

B. CORRECTIVE ACTION

The operator is not required to take any corrective action on any well within the area of review before the effective date of this permit.

C. WELL OPERATION

1. Transition from Rule to Permit Authorization. The Courchene No. 1-D has been operating since before June 25, 1984. Adherence to all requirements under 40 CFR 144, 146, and 147, including construction and mechanical integrity, has been verified. Injection activities for the Courchene No. 1-D are no longer authorized by rule with final issuance of this permit. Injection activities are authorized, through this permit, to continue, provided all conditions of this permit are met.

2. Mechanical Integrity (Subsequent to Initial Demonstration).

(a) Method of Demonstrating Mechanical Integrity. A demonstration of the absence of significant leaks in the tubing must be made by performing a tubing pressure test. This test shall be for a minimum of forty-five (45) minutes at a pressure of 300 pounds per square inch gage (psig) measured at the surface. The tubing shall be filled with injection fluid at least twenty-four (24) hours in advance of the test. Pressure values shall be recorded at five-minute intervals or less. A well passes the mechanical integrity test if there is less than a ten (10) percent decrease or increase in pressure over the forty-five (45) minute period.

(b) Schedule for Demonstration of Mechanical Integrity. A demonstration of mechanical integrity shall be made at regular intervals, no less frequently than every two (2) years from the effective date of this permit, in accordance with 40 CFR 146.8 and paragraph (a) above, unless otherwise modified. Initiation of mechanical integrity demonstrations will be according to the following provisions:

(i) It shall be the permittee's responsibility to arrange and conduct the routine two-year tubing pressure test demonstration. The permittee shall notify the Director of his intent to demonstrate mechanical integrity at least thirty (30) days prior to such demonstration. Results of the test shall be submitted to the Director as soon as possible but no later than sixty (60) days after the demonstration.

(ii) In addition to any demonstration made under paragraph (i) above, the Director may require a demonstration of mechanical integrity at any time during the permitted life of the well.

(c) Loss of Mechanical Integrity. If the well fails to demonstrate mechanical integrity during a test, or a loss of mechanical integrity as defined by 40 CFR 146.8 becomes evident during operation, the permittee shall notify the Director in accordance with Part III, Section E. 10. of this permit.

Furthermore, injection activities shall be terminated immediately; and operation shall not be resumed until the permittee has taken necessary actions to restore integrity to the well and EPA gives approval to recommence injection.

3. Injection Interval. Injection shall be limited to the Judith River Formation in the subsurface interval 1,418 feet to 1,441 feet.

4. Injection Pressure Limitation.

- (a) Injection pressure, measured at the surface, shall not exceed 750 psig, as requested by the permittee.
- (b) The pressure limit in paragraph (a) may be increased by the Director if the fracture pressure of the injection formation will not be exceeded, and the permittee demonstrates either:
 - (i) that the proposed increase in surface injection pressure is necessary to overcome friction losses in the injection system. This demonstration shall be made by performing a step rate injection test, using fluid normally injected, to determine both the instantaneous shut-in pressure (ISIP) and the formation breakdown pressure. The Director will determine any allowable increase based upon the test results and other parameters reflecting actual injection operations; or
 - (ii) that the proposed increase in surface injection pressure is necessary to inject the volume rate of fluid set by Part II, Section C. 5., below. The demonstration required under this paragraph will be based upon the specific injection operation. It will include a step-rate test if the request is for a surface injection pressure in excess of 775 psig. For requested pressures lower than this, injection volume and pressure records may adequately demonstrate the need.
- (c) The permittee shall give thirty (30) days advance notice to the Director if the increase in paragraph (b) will be sought. Details of the proposed test shall be submitted at least seven (7) days in advance of the proposed test date so that the Director has adequate time to review and approve the test procedures. Results of all tests shall be submitted to the Director within ten (10) days of the test. Injection at the increased pressure must be approved by the Director, in writing, before the permittee may begin continuous operation at that pressure.

- (d) Any approval granted by the Director for the increased pressure limitations as stated in paragraph (b) shall be made part of this permit by minor modification without further opportunity for public comment.

5. Injection Volume Limitation. No more than 1,800 barrels of water per day (BWPD) of produced water from the Nisku and Madison Formations shall be injected into this well provided further that in no case shall injection pressure exceed that limit shown in Part II, Section C. 4. (a) of this permit.

6. Injection Fluid Limitation. The permittee shall not inject any hazardous substances, as defined by 40 CFR 261, at any time during the operation of the facility; and further, no substances other than those defined in the permit application shall be injected.

7. Annular Fluid. The annulus between the tubing and the casing is filled with cement.

D. MONITORING, RECORDKEEPING, AND REPORTING OF RESULTS

1. Injection Well Monitoring Program. Samples and measurements shall be representative of the monitored activity. The permittee shall utilize the applicable analytical methods described in Table 1 of 40 CFR 136.3, or in Appendix III of 40 CFR Part 261, or in certain circumstances, by other methods that have been approved by the EPA Administrator. Monitoring shall consist of:

(a) Analysis of the injection fluids, performed:

(i) quarterly for Total Dissolved Solids, pH, Specific Conductivity, and Specific Gravity; and

(ii) whenever there is a change in the source of injection fluids. A comprehensive water analysis shall be submitted to the Director within thirty (30) days of any change in injection fluids.

(b) Weekly observations of injection pressure, flow rate and cumulative volume. At least one observation of the injection pressure, flow rate, and cumulative volume, shall be recorded at regular intervals no greater than thirty (30) days;

(c) The permittee may request that the frequency of analysis in paragraph (a)(i) above, be reduced after the first year if the reduced frequency will yield data representative of the nature of the injected fluids. The reduced frequency shall not be less than once per year.

2. Monitoring Information. Records of any monitoring activity required under this permit shall include:

- (a) The date, exact place, the time of sampling or field measurements;
- (b) The name of the individual(s) who performed the sampling or measurements;
- (c) The exact sampling method(s) used to take samples;
- (d) The date(s) laboratory analyses were performed;
- (e) The name of the individual(s) who performed the analyses;
- (f) The analytical techniques or methods used by laboratory personnel; and
- (g) The results of such analyses.

3. Recordkeeping.

- (a) The permittee shall retain records concerning:
 - (i) the nature and composition of all injected fluids until three (3) years after the completion of plugging and abandonment which has been carried out in accordance with the Plugging and Abandonment Plan shown in Appendix C, and is consistent with 40 CFR 146.10.
 - (ii) all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation and copies of all reports required by this permit for a period of at least five (5) years from the date of the sample, measurement or report throughout the operating life of the well.
- (b) The permittee shall continue to retain such records after the retention period specified in paragraphs (a) (i) and (a) (ii) unless he delivers the records to the Director or obtains written approval from the Director to discard the records.

4. Reporting of Results. The permittee shall submit an Annual Report to the Director summarizing the results of the monitoring required by Part II, Section D. 1. of this permit. Copies of all monthly records on injected fluids, and any major changes in characteristics or sources of injected fluid shall be included in the Annual Report. The first Annual Report shall cover the period from the effective date of the permit through December 31. Subsequently, the Annual Report shall cover the period from January 1 through December 31, and shall be submitted by January 15 of the following year. Appendix B contains Form 7520-11 which may be copied and used to submit the annual summary of monitoring.

E. PLUGGING AND ABANDONMENT

1. Notice of Plugging and Abandonment. The permittee shall notify the Director forty-five (45) days before conversion, workover, or abandonment of the well.

2. Plugging and Abandonment Plan. The permittee shall plug and abandon the well as provided in the Plugging and Abandonment Plan, Appendix C. This plan incorporates information supplied by the permittee AND ADDITIONAL REQUIREMENTS SET FORTH BY THE EPA. EPA reserves the right to change the manner in which the well will be plugged if the well is modified during its permitted life or if the well is not made consistent with EPA requirements for construction and mechanical integrity. The Director may ask the permittee to update the estimated plugging cost periodically. Such estimates shall be based upon costs which a third party would incur to plug the well according to the plan.

3. Cessation of Injection Activities. After a cessation of operations of two (2) years, the permittee shall plug and abandon the well in accordance with the Plugging and Abandonment Plan, unless he:

- (a) has provided notice to the Director; and
- (b) has demonstrated that the well will be used in the future; and
- (c) has described actions or procedures, satisfactory to the Director, that will be taken to ensure that the well will not endanger underground sources of drinking water during the period of temporary abandonment.

4. Plugging and Abandonment Report. Within sixty (60) days after plugging the well, the permittee shall submit a report on Form 7520-13 to the Director. The report shall be certified as accurate by the person who performed the plugging operation and the report shall consist of either: (1) a statement that the well was plugged in accordance with the plan; or (2) where actual plugging differed from the plan, a statement that specifies the different procedures followed.

F. FINANCIAL RESPONSIBILITY

1. Demonstration of Financial Responsibility. The permittee is required to maintain continuous financial responsibility and resources to close, plug, and abandon the injection well as provided in the plugging and abandonment plan.

- (a) A surety performance bond in the amount of \$125,000.00 with an attached rider policy increasing the amount of the bond to \$175,000.00 underwritten by United States Fidelity And Guaranty Company, which names EPA as beneficiary in the event of permittee default in the plugging and abandonment requirements, is hereby incorporated as part of this permit. The standby trust agreement established by the permittee shall remain in effect for the duration of this permit, unless part (b), below, has been complied with.

- (b) The permittee may, upon written request to EPA, change the type of financial mechanism or instrument utilized. A change in demonstration of financial responsibility must be approved by the Director. A minor permit modification will be made to reflect any change in financial mechanisms, without further opportunity for public comment.

2. Insolvency of Financial Institution. In the event that an alternate demonstration of financial responsibility has been approved under (b) or (c), above, the permittee must submit an alternate demonstration of financial responsibility acceptable to the Director within sixty (60) days after either of the following events occur:

- (a) The institution issuing the trust or financial instrument files for bankruptcy; or
- (b) The authority of the trustee institution to act as trustee, or the authority of the institution issuing the financial instrument, is suspended or revoked.

PART III. GENERAL PERMIT CONDITIONS

A. EFFECT OF PERMIT

The permittee is allowed to engage in underground injection in accordance with the conditions of this permit. The permittee, as authorized by this permit, shall not construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR, Part 142 or otherwise adversely affect the health of persons. Any underground injection activity not authorized in this permit or otherwise authorized by permit or rule is prohibited. Issuance of this permit does not convey property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of State or local law or regulations. Compliance with the terms of this permit does not constitute a defense to any enforcement action brought under the provisions of Section 1431 of the Safe Drinking Water Act (SDWA) or any other law governing protection of public health or the environment for any imminent and substantial endangerment to human health, or the environment, nor does it serve as a shield to the permittee's independent obligation to comply with all UIC regulations.

B. PERMIT ACTIONS

1. Modification, Reissuance, or Termination. The Director may, for cause or upon a request from the permittee, modify, revoke and reissue, or terminate this permit in accordance with 40 CFR Sections 124.5, 144.12, 144.39, and 144.40. Also, the permit is subject to minor modifications for cause as specified in 40 CFR Section 144.41. The filing of a request for a permit modification, revocation and reissuance, or termination or the notification of planned changes or anticipated noncompliance on the part of the permittee does not stay the applicability or enforceability of any permit condition.

2. Transfers. This permit is not transferrable to any person except after notice is provided to the Director and the requirements of 40 CFR 144.38 are complied with. The Director may require modification, or revocation and reissuance, of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the SDWA.

C. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

D. CONFIDENTIALITY

In accordance with 40 CFR Part 2 and 40 CFR 144.5, any information submitted to EPA pursuant to this permit may be claimed as confidential by the submitter. Any such claim must be asserted at the time of submission by stamping the words "confidential business information" on each page containing such information. If no claim is made at the time of submission, EPA may make the information available to the public without further notice. If a claim is asserted, the validity of the claim will be assessed in accordance with the procedures in 40 CFR Part 2 (Public Information). Claims of confidentiality for the following information will be denied:

- The name and address of the permittee, and
- Information which deals with the existence, absence or level of contaminants in drinking water.

E. GENERAL DUTIES AND REQUIREMENTS

1. Duty to Comply. The permittee shall comply with all conditions of this permit, except to the extent and for the duration such noncompliance is authorized by an emergency permit. Any permit noncompliance constitutes a violation of the SDWA and is grounds for enforcement action, permit termination, revocation and reissuance, or modification. Such non-compliance may also be grounds for enforcement action under the Resource Conservation and Recovery Act (RCRA).

2. Penalties for Violations of Permit Conditions. Any person who violates a permit requirement is subject to civil penalties, fines, and other enforcement action under the SDWA and may be subject to such actions pursuant to the RCRA. Any person who willfully violates permit conditions may be subject to criminal prosecution.

3. Need to Halt or Reduce Activity not a Defense. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

4. Duty to Mitigate. The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit.

5. Proper Operation and Maintenance. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this permit.

6. Duty to Provide Information. The permittee shall furnish the Director, within a time specified, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

7. Inspection and Entry. The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

- (a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this permit;
- (b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
- (c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
- (d) Sample or monitor, at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the SDWA any substances or parameters at any location.

8. Records of Permit Application. The permittee shall maintain records of all data required to complete the permit application and any supplemental information submitted for a period of five (5) years from the effective date of this permit. This period may be extended by request of the Director at any time.

9. Signatory Requirements. All reports or other information requested by the Director shall be signed and certified according to 40 CFR 144.32.

10. Reporting of Noncompliance.

- (a) Anticipated Noncompliance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.
- (b) Compliance Schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than thirty (30) days following each schedule date.

(c) Twenty-four Hour Reporting.

(i) The permittee shall report to the Director any noncompliance which may endanger health or the environment. Information shall be provided orally within twenty-four (24) hours from the time the permittee becomes aware of the circumstances by telephoning EPA at (303) 293-1413 (during normal business hours) or at (303) 293-1788 (for reporting at all other times). The following information shall be included in the verbal report:

- (A) Any monitoring or other information which indicates that any contaminant may cause endangerment to an underground source of drinking water.
- (B) Any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between underground sources of drinking water.

(ii) A written submission shall also be provided within five (5) days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

(d) Other Noncompliance. The permittee shall report all other instances of noncompliance not otherwise reported at the time monitoring reports are submitted. The reports shall contain the information listed in Part III, Section E. 10. (C) (ii) of this permit.

(e) Other Information. Where the permittee becomes aware that he failed to submit any relevant facts in the permit application, or submitted incorrect information in a permit application or in any report to the Director, the permittee shall submit such correct facts or information within two (2) weeks of the time such information became known to him.

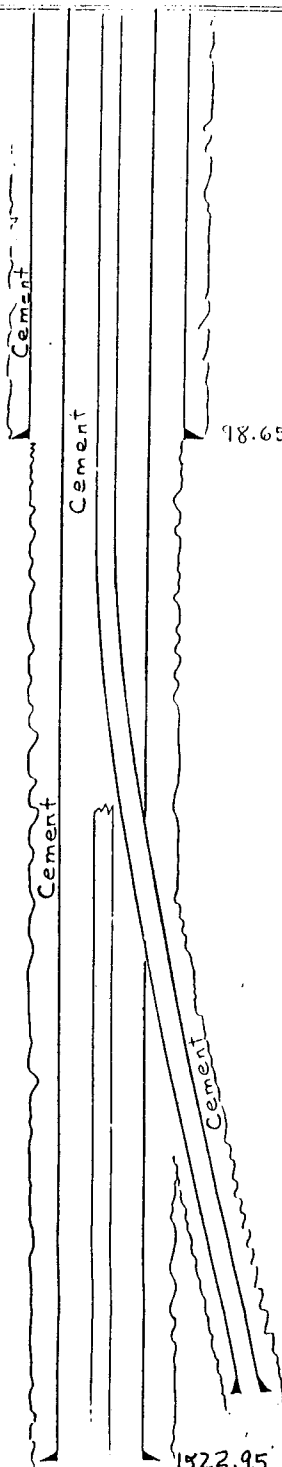
APPENDIX A
(Construction Details)

Casing and Cementing Information for Courchene No. 1-D

- (a) Surface casing (8-5/8 inch) is set in a 12-1/4 inch diameter hole to a depth of 99 feet. The casing is secured with ready mix and neat cement. The cement was circulated to the surface, isolating the casing from the well bore. The operator did not supply any evidence to demonstrate the quality of cement bonding between the casing and well bore.
- (b) Long string casing (5-1/2 inch) is set in a 7-7/8 inch diameter hole to a depth of 1,523 feet. This casing is secured with 230 sacks of cement at a depth of 1,524 feet and cement was circulated to the surface. Due to parting of the original tubing at a depth of 350 feet, a 4-3/4 inch hole was drilled, going out of the casing at approximately 350 feet, to a depth of 1,493 feet. The new 2-7/8 tubing was cemented in place at a depth of 1,484 feet with 200 sacks of Class G cement. An additional 75 sacks were pumped down the annulus so that the tubing would be cemented to the surface. The plugged back total depth (PBTD) was tagged at a depth of 1,442 feet and perforations were shot between 1,418 feet and 1,441 feet.

COURCHENE SWD NO. 1 WELLBORE SKETCH
EPA PERMIT APPLICATION - UIC REGULATIONS

WELL NAME & NO.	DEPTH	FORMATION
Courchene SWD No. 1		Judith River
LOCATION (SHOW DISTANCE FROM BOUNDARIES, ABSTRACT OR TITLE NO., SECTION, TWP., RGE., COUNTY, STATE, ETC.)		
801' FSL and 2034' FWL of Sec. 4-T30N-R46E, Roosevelt County, Montana		
		FIELD AREA
		Volt Field



18.65' 8 3/8", 2 1/4", J-55
Cemented w/2 yards of ready mix and
12 sacks of neat cement to the surface.

1484' 2 7/8", 6.5#, J-55
Cemented w/200 sacks class G with good cement returns.
Pumped 75 sacks Class G cement down annulus to cement
around casing part at 350'.
1522.95' 5 1/2" 15.5# J-55

APPENDIX B
(Reporting Forms)

1. EPA Form 7520- 7: APPLICATION TO TRANSFER PERMIT
2. EPA Form 7520-10: COMPLETION REPORT FOR BRINE DISPOSAL ... WELL
3. EPA Form 7520-11: ANNUAL DISPOSAL/INJECTION WELL MONITORING REPORT
4. EPA Form 7520-12: WELL REWORK RECORD
5. EPA Form 7520-13: PLUGGING RECORD



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

APPLICATION TO TRANSFER PERMIT

NAME AND ADDRESS OF EXISTING PERMITTEE	NAME AND ADDRESS OF SURFACE OWNER

LOCATE WELL AND OUTLINE UNIT ON SECTION PLAT — 640 ACRES		STATE _____	COUNTY _____	PERMIT NUMBER _____
SURFACE LOCATION DESCRIPTION				
W OF _____		W OF _____		1/4 SECTION _____
TOWNSHIP _____		RANGE _____		
LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT				
Surface Location _____ ft. from (N/S) _____ Line of quarter section				
and _____ ft. from (E/W) _____ Line of quarter section				
WELL ACTIVITY		WELL STATUS		TYPE OF PERMIT
<input type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Brine Disposal <input type="checkbox"/> Enhanced Recovery <input type="checkbox"/> Hydrocarbon Storage <input type="checkbox"/> Class III <input type="checkbox"/> Other		<input type="checkbox"/> Operating <input type="checkbox"/> Modification/Conversion <input type="checkbox"/> Proposed		<input type="checkbox"/> Individual <input type="checkbox"/> Area Number of Wells _____
Lease Name _____		Well Number _____		

NAME(S) AND ADDRESS(ES) OF NEW OWNER(S)	NAME AND ADDRESS OF NEW OPERATOR
---	----------------------------------

Attach to this application a written agreement between the existing and new permittee containing a specific date for transfer of permit responsibility, coverage, and liability between them.

The new permittee must show evidence of financial responsibility by the submission of surety bond, or other adequate assurance, such as financial statements or other materials acceptable to the director.

CERTIFICATION

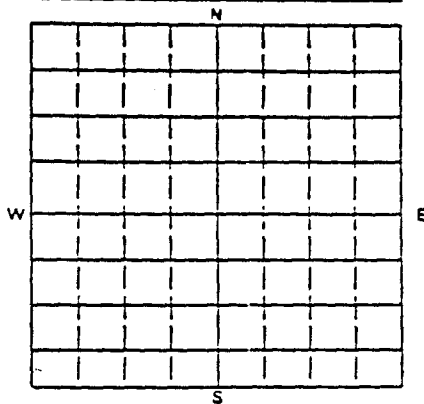
I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. (Ref. 40 CFR 122.6).

NAME AND OFFICIAL TITLE (Please type or print)	SIGNATURE	DATE SIGNED
--	-----------	-------------

COMPLETION REPORT FOR BRINE DISPOSAL,
HYDROCARBON STORAGE, OR ENHANCED RECOVERY WELL

NAME AND ADDRESS OF EXISTING PERMITTEE

NAME AND ADDRESS OF SURFACE OWNER

LOCATE WELL AND OUTLINE UNIT ON
SECTION PLAT — 640 ACRES²

STATE

COUNTY

PERMIT NUMBER

SURFACE LOCATION DESCRIPTION

1/4 OF

1/4 OF

1/4 SECTION

TOWNSHIP

RANGE

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface

Location _____ ft. from (N/S) _____ Line of quarter section

and _____ ft. from (E/W) _____ Line of quarter section

WELL ACTIVITY

TYPE OF PERMIT

☐ Brine Disposal☐ IndividualEstimated Fracture Pressure
of Injection Zone☐ Enhanced Recovery☐ Area☐ Hydrocarbon Storage

Number of Wells _____

Anticipated Daily Injection Volume (Bbls)

Injection Interval

Average

Maximum

Feet

to Feet

Anticipated Daily Injection Pressure (PSI)

Depth to Bottom of Lowermost Freshwater Formation

Average

Maximum

(Feet)

Type of Injection Fluid (Check the appropriate block(s))

☐ Salt Water☐ Brackish Water☐ Fresh Water☐ Liquid Hydrocarbon☐ Other

Lease Name

Well Number

Name of Injection Zone

Date Drilling Began

Date Well Completed

Permeability of Injection Zone

Date Drilling Completed

Porosity of Injection Zone

CASING AND TUBING

CEMENT

HOLE

OD Size

Wt/Ft — Grade — New or Used

Depth

Sacks

Class

Depth

Bit Diameter

INJECTION ZONE STIMULATION

WIRE LINE LOGS, LIST EACH TYPE

Interval Treated

Materials and Amount Used

Log Types

Logged Intervals

Complete Attachments A — E listed on the reverse.

CERTIFICATION

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32).

NAME AND OFFICIAL TITLE (Please type or print)

DATE SIGNED

ANNUAL DISPOSAL/INJECTION WELL MONITORING REPORT

NAME AND ADDRESS OF EXISTING PERMITTEE

NAME AND ADDRESS OF SURFACE OWNER

LOCATE WELL AND OUTLINE UNIT ON
SECTION PLAT — 640 ACRES

STATE

COUNTY

PERMIT NUMBER

SURFACE LOCATION DESCRIPTION

1/4 QF

14 OF

1/4 SECTION

TOWNSHIP

RANGE

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface

Location _____ ft. from (N/S) _____ Line of quarter section

and _____ ft. from (E/W) _____ Line of quarter section

WELL ACTIVITY

TYPE OF PERMIT

Brine Disposal

☐ Individual☐ Enhanced Recovery

☐ Area

☐ Hydrocarbon Storage

Number of Wells _____

Lease Name

Well Number

INJECTION PRESSURE

TOTAL VOLUME INJECTED

**TUBING — CASING ANNULUS PRESSURE
(OPTIONAL MONITORING)**

MONTH YEAR

YEAR

AVERAGE PSIG

MAXIMUM PSIG

SBL

MCF

MINIMUM PSIG

MAXIMUM PSIG

[illegible]

CERTIFICATION

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32).

NAME AND OFFICIAL TITLE (Please type or print)

SIGNATURE

DATE SIGNED _____

/N

STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

WELL REWORK RECORD



NAME AND ADDRESS OF PERMITTEE

NAME AND ADDRESS OF CONTRACTOR

LOCATE WELL AND OUTLINE UNIT ON
SECTION PLAT — 640 ACRES

STATE

COUNTY

PERMIT NUMBER

SURFACE LOCATION DESCRIPTION

1/4 OF

1/4 OF

1/4 SECTION

TOWNSHIP

RANGE

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface

Location _____ ft. from (N/S) _____ Line of quarter section

and _____ ft. from (E/W) _____ Line of quarter section

WELL ACTIVITY

- ☐ Brine Disposal
☐ Enhanced Recovery
☐ Hydrocarbon Storage

Lease Name

Total Depth Before Rework

Total Depth After Rework

Date Rework Commenced

Date Rework Completed

TYPE OF PERMIT

☐ Individual☐ Area

Number of Wells _____

Well Number

WELL CASING RECORD — BEFORE REWORK

Casing		Cement		Perforations		Acid or Fracture Treatment Record
Size	Depth	Sacks	Type	From	To	

WELL CASING RECORD — AFTER REWORK (Indicate Additions and Changes Only)

Casing		Cement		Perforations		Acid or Fracture Treatment Record
Size	Depth	Sacks	Type	From	To	

DESCRIBE REWORK OPERATIONS IN DETAIL
USE ADDITIONAL SHEETS IF NECESSARY

WIRE LINE LOGS, LIST EACH TYPE

Log Types

Logged Intervals

CERTIFICATION

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32).

NAME AND OFFICIAL TITLE (Please type or print)

SIGNATURE

DATE SIGNED

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

PLUGGING RECORD

NAME AND ADDRESS OF PERMITTEE

NAME AND ADDRESS OF CEMENTING COMPANY

LOCATE WELL AND OUTLINE UNIT ON
SECTION PLAT — 640 ACRES

N									
S									

STATE

COUNTY

PERMIT NUMBER

SURFACE LOCATION DESCRIPTION

1/4 OF

1/4 OF

1/4 SECTION

TOWNSHIP

RANGE

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface

Location _____ ft. from (N/S) _____ Line of quarter section

and _____ ft. from (E/W) _____ Line of quarter section

TYPE OF PERMIT

- ☐
- Individual
-
- ☐
- Area

Number of Wells _____

Describe in detail the manner in which the fluid was placed and
the method used in introducing it into the hole

CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT(LB./FT.)	PUT IN WELL (FT.)	LEFT IN WELL (FT.)	HOLE SIZE

WELL ACTIVITY

METHOD OF EMPLACEMENT OF
CEMENT PLUGS

- ☐
- Brine Disposal
-
- ☐
- Enhanced Recovery
-
- ☐
- Hydrocarbon Storage

- ☐
- The Balance Method
-
- ☐
- The Dump Bailer Method
-
- ☐
- The Two-Plug Method

Lease Name _____

Well Number _____

CEMENTING TO PLUG AND ABANDON DATA

PLUG #1

PLUG #2

PLUG #3

PLUG #4

PLUG #5

PLUG #6

PLUG #7

Cementing Date _____

Size of Hole or Pipe in which Plug Placed (inches) _____

Depth to Bottom of Tubing or Drill Pipe (ft.) _____

Seals of Cement Used (each plug) _____

Slurry Volume Pumped (cu. ft.) _____

Calculated Top of Plug (ft.) _____

Measured Top of Plug (if tagged ft.) _____

Slurry Wt. (Lb./Gal.) _____

Type Cement _____

LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS

From	To	From	To

Signature of Cementer or Authorized Representative _____

Signature of EPA Representative _____

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. (Ref. 40 CFR 122.22).

NAME AND OFFICIAL TITLE (Please type or print)

SIGNATURE

DATE SIGNED

APPENDIX C
(Plugging & Abandonment Plan)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

REC. PRG.

JUN 3 - 1985

PLUGGING AND ABANDONMENT PLAN

NAME AND ADDRESS OF FACILITY

COURCHENE 1-D

NAME AND ADDRESS OF OWNER/OPERATOR
MURPHY OIL USA, INC.200 PEACH STREET
EL DORADO, AR 71730LOCATE WELL AND OUTLINE UNIT ON
SECTION PLAT — 640 ACRES

N							
S							

W E

STATE

MT

COUNTY

ROOSEVELT

PERMIT NUMBER

SURFACE LOCATION DESCRIPTION

NE 1/4 OF SE 1/4 OF SW 1/4 SECTION 4 TOWNSHIP 30N RANGE 46E

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface

Location 801 ft. from (N/S) S Line of quarter section

and 2034 ft. from (E/W) W Line of quarter section

TYPE OF AUTHORIZATION

- ☐ Individual Permit
☐ Area Permit
☒ Rule

Number of Wells _____

Lease Name COURCHENE

WELL ACTIVITY

- ☐ CLASS I
☒ CLASS II
☐ Brine Disposal
☐ Enhanced Recovery
☐ Hydrocarbon Storage
☐ CLASS III

Well Number 1-D

CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT(LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE
8 5/8	24#	98.65	92.65	12 1/2
5 1/2	15.5#	1522.95	1416.95	7 7/8
2 7/8	6.5#	1484	1478	4 1/2 / 5 1/2

METHOD OF EMPLACEMENT OF CEMENT PLUGS

- ☒ The Balance Method
☐ The Dump Bailer Method
☐ The Two-Plug Method
☐ Other

CEMENTING TO PLUG AND ABANDON DATA:

	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
Size of Hole or Pipe in which Plug Will Be Placed (inches)	2 7/8						
Depth to Bottom of Tubing or Drill Pipe (ft.)	1441						
Sacks of Cement To Be Used (each plug)	50						
Slurry Volume To Be Pumped (cu. ft.)	57.5						
Calculated Top of Plug (ft.)	6'						
Measured Top of Plug (if tagged ft.)							
Slurry Wt. (Lb./Gal.)							
Type Cement or Other Material (Class III)							

LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (if any)

From	To	From	To
1418	1441		

Estimated Cost to Plug Wells

\$ 25,000

CERTIFICATION

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

NAME AND OFFICIAL TITLE (Please type or print)

Alvin W. Simpson
Manager of Operations

SIGNATURE

DATE SIGNED

June 19, 1985

Page 26 of 27

EPA Permit No. MTS2301-0611

Addendum to Plugging and Abandonment Plan

As additions to the plan submitted by the applicant, EPA is requiring that the plug be set with sufficient cement to extend to the surface. The original plan is modified so that the top of cement (TOC) will be at a depth of zero feet.

STATEMENT OF BASIS

MURPHY OIL USA, INCORPORATED
COURCHENE NO. 1-D WELL, ROOSEVELT COUNTY, MONTANA

UIC PERMIT NUMBER: MTS2301-0611

CONTACTS: Marc E. Herman
U. S. Environmental Protection Agency
Ground Water Section, 8WM-DW
One Denver Place
999 18th Street, Suite 1300
Denver, Colorado 80202-2413
Telephone: (303) 293-1422

U. S. Environmental Protection Agency
Montana Office
Federal Building, Drawer 10096
301 South Park
Helena, Montana 59626
Telephone: (406) 449-5414

DESCRIPTION OF FACILITY AND BACKGROUND INFORMATION:

On June 4, 1986, Murphy Oil USA, Incorporated, El Dorado, Arkansas, made application for an underground injection control permit for disposal, by means of injection procedures, of salt water from the Nisku and Madison Formations into the Judith River Formation. The area covered by the application is in a portion of the Volt Field, located in the SW 1/4 of section 4, T30N, R46E in Roosevelt County, Montana.

The Courchene No. 1-D is currently authorized by rule, therefore the permit will serve to transfer authorization from rule to permit. As such, a corrective action requirement is not specifically applicable.

The Judith River Formation, within this area, has a fluid total dissolved solids (TDS) content of between 3,000 and 10,000 mg/l. The Courchene No. 1-D well was in operation prior to June 25, 1984 (effective date of the Underground Injection Control [UIC] program in Montana) and was automatically granted an aquifer exemption extending in a 1/4-mile radius from the well bore. This was done for all existing injection wells that were eligible for 1/4-mile aquifer exemptions.

A recent EPA report concluded that the Judith River Formation in the Volt Field area was mostly likely an underground source of drinking water (USDW) prior to injection activities. In the report, it was initially concluded that the Courchene No. 1-D should not be authorized to continue to operate because, based on assumed hydrogeologic parameters, the injection fluid plume had theoretically extended beyond the 1/4-mile aquifer exemption boundary. Subsequent calculations, using site specific data supplied by Murphy Oil, were performed to confirm or deny the report results. These calculations suggest that the well may be operated, conservatively, for several years before the limit will be reached and therefore should be issued a permit.

Approximately 1,600 barrels of water (total) will be injected each day utilizing the Courchene No. 1-D well. The operator has requested that the maximum injection rate be set at 1,800 barrels of water per day (BWPD).

The injection tubing is cemented into place and therefore need not undergo a casing/tubing annulus pressure test. The permittee is, however, required to demonstrate tubing mechanical integrity through tubing pressure tests. This demonstration will be performed before issuance of the final permit.

Murphy Oil USA has submitted all required information and data necessary for permit issuance in accordance with 40 CFR Parts 144, 146 and 147, and a draft permit has been prepared.

The permit will be issued such that it will expire at a specific point in time. The following discussion will explain why operation of the Courchene No. 1-D will be limited to six (6) years, starting as of January 1, 1987. Reapplication at the end of the six-year period will not be considered. During the six-year period, no reapplication will be necessary unless the permit is terminated for reasonable cause (40 CFR 144.39, 144.40 and 144.41). The permit will be reviewed every two (2) years.

This Statement of Basis gives the derivation of the site specific permit conditions and reasons for them. The general permit conditions for which the content is mandatory and not subject to site specific differences (based on 40 CFR Parts 144, 146 and 147), are not included in the discussion.

PART II, Section A WELL CONSTRUCTION REQUIREMENTS

Casing and Cementing

(Condition 1)

A casing and cementing plan was submitted with the permit application. For the disposal well, construction is as follows:

- (1) Surface casing (8-5/8 inch) is set in a 12-1/4 inch diameter hole to a depth of 99 feet. The casing is secured with ready mix and neat cement. The cement was circulated to the surface, isolating the casing from the well bore.
- (2) Long string casing (5-1/2 inch) is set in a 7-7/8 inch diameter hole to a depth of 1,523 feet. This casing is secured with 230 sacks of cement at a depth of 1,524 feet, and cement was circulated to the surface. Due to parting of the original tubing at a depth of 350 feet, a 4-3/4 inch hole was drilled, going out of the casing at approximately 350 feet, to a depth of 1,493 feet. The new 2-7/8 tubing was cemented in place at a depth of 1,484 feet with 200 sacks of Class G cement. An additional 75 sacks were pumped down the annulus so that the tubing would be cemented to the surface. The plugged back total depth (PSTD) was tagged at a depth of 1,442 feet and perforations were shot between 1,418 feet and 1,441 feet.

USDWs within this area that are at sufficient depths to be of concern are Tertiary sand deposits, as reported by the permittee. The maximum depth for these aquifers is 200 feet. The well bore-casing annulus of the disposal well is filled with cement through the subsurface intervals occupied by these aquifers, and it is therefore believed that these USDWs will be adequately protected.

Tubing and Packer Specifications

(Condition 2)

The tubing is cemented in place, therefore there is no need for a packer.

Monitoring Devices

(Condition 3)

For the purposes of taking tubing pressure measurements, the EPA is requiring that the permittee install a 1/2 inch fitting with a cut-off valve at the well head on the tubing.

EPA is further requiring the permittee to install a sampling tap on the line to the disposal well. Also required is a flow meter that will be used to measure cumulative volumes of injected fluid.

Formation Testing

(Condition 5)

The permittee has performed a step-rate test for the Judith River Formation and has reported the results. The fracture pressure is approximately 850 pounds per square inch gauge (psig) at the surface. The Courchene No. 1-D shall be operated at a pressure level of no more than 750 psig.

PART II, Section B CORRECTIVE ACTION

Corrective Action

The applicant was not required to submit area of review information.

PART II, Section C WELL OPERATION

Mechanical Integrity

(Condition 2)

A tubing pressure test must be repeated at least every two (2) years to demonstrate continued tubing integrity. The permittee is required to demonstrate tubing integrity, using an EPA-approved method, prior to issuance of the final permit.

Injection Interval

(Condition 3)

Injection will be limited to the Judith River Formation in the subsurface interval 1,418 feet to 1,441 feet.

Injection Pressure Limitation

(Condition 4)

The maximum proposed injection pressure is 750 psig; the average is 500 psig. The applicant supplied results of a recent step-rate test (performed 9/25/86) for the Judith River Formation. Graphing the data, it appears that the formation was fractured at approximately 850 psig. A value for fracture pressure at a specific depth (top of perforations at 1,418 feet) can be calculated.

The first equation to be used is

$$P_d = 12Sh \quad (1)$$

Where,

- P_d = hydrostatic pressure at a specific depth (psig)
- S = specific weight of fluid in pounds per cubic inch (pci)
- h = height of fluid column (or a specific depth) in feet
- 12 = conversion factor for inches and feet

NOTE: specific weight of fluid is 0.037 pci.

$$P_d = (12)(0.037)(1418) = 630 \text{ psig}$$

Fracture pressure at a specific depth can be calculated with a second equation, as follows:

$$P_w + P_d = P_i \quad (2)$$

Where,

- P_w = fracture or injection pressure at the surface (psig)
- P_d = hydrostatic pressure at a specific depth (psig)
- P_i = pressure, due to injection/fracturing, at a specific depth (psig)

Substituting the value of 850 psig for P_w and 630 psig for P_d , the pressure, due to fracturing activities, at a depth of 1,418 feet is

$$850 \text{ psig} + 630 \text{ psig} = 1480 \text{ psig}$$

Calculations for the maximum proposed surface injection pressure ($P_w = 750$ psig) are as follow (for the injection fluid, $S = 0.037$ pci):

$$P_d = (12)(0.037)(1418) = 630 \text{ psig}$$

and with $P_w = 750$ psig = maximum proposed injection pressure,

$$750 \text{ psig} + 630 \text{ psig} = 1380 \text{ psig}$$

The value of 1,380 psig represents pressure, at the specified depth, caused by a surface injection pressure of 750 psig and is the maximum proposed injection pressure at the same depth as the calculated fracture pressure. In comparing this value to the fracture pressure (1480 psig), it appears that Murphy Oil is operating below the fracture pressure limitation. It has been concluded that the Courchene No. 1-D will be allowed to continue to operate.

Injection Volume Limitation

(Condition 5)

Injection volume will be limited to a maximum of 1,800 BWP, as requested in the permit application. Average daily salt water injections are expected to be approximately 1,600 barrels.

Several calculations were performed in order to verify that proposed injection pressures and rates are compatible. Results from equations (3), (4), and (5) indicate that the operational life of the Courchene No. 1-D will be limited to a specified period of time. The calculations are as follow:

$$V = (\pi r^2 b n) / 5.6 \quad (3)$$

$$T = V / 365Q \quad (4)$$

Where,

- V = available subsurface injection zone volume to be filled (barrels)
- r = radial distance of 1/4-mile aquifer exemption (feet)
- b = thickness of injection zone in feet
- n = porosity of injection formation (dimensionless)
- 5.6 = conversion factor for barrels and ft^3
- Q = injection rate (BWP)
- T = time it will take to fill the available volume (years)

Equation (3) was used to estimate the theoretical volume of fluid necessary to fill up the subsurface cylinder defined by a radius of 1/4 mile. As the Courchee No. 1-D has been operating for approximately 21 years, it was first necessary to calculate the volume filled so far.

Q_1 = average injection rate during time period (BWPD) = 1348 BWPD
 V_1 = volume filled to date (barrels)
 T_1 = time period (years) = 21 years

$$V_1 = 365Q_1T_1 = (365)(1348)(21) = 1.0330390E07 \text{ barrels}$$

Currently, a portion of the Judith River Formation extending a radial distance of 1/4 mile from the Courchee No. 1-D well bore is exempted. Ideally this implies that the injected fluid plume shall not extend beyond the 1/4-mile limit. All equations used in this analysis neglect the effects of salt-water dispersion within the formation, therefore a safety factor of 5% will be incorporated to account for the phenomena of molecular diffusion and mechanical dispersion.

5% of 1/4 mile is 66 feet or 0.0125 miles,

$$0.25 - 0.0125 = 0.2375 \text{ miles} = 1254 \text{ feet.}$$

This factor reduces the areal extent of the subsurface cylinder by 10%. The value of 1,254 feet will be used as the radial distance (r) instead of the 1/4 mile value (1320 feet). In this way, a safety margin of 10% will be provided for calculations involving an acceptable radius of influence.

Calculation of the total, theoretical volume available (V_T) was accomplished by substituting 1254 feet for "r", 52 feet for "b", and 0.32 for "n".

$$V_T = [(\pi)(1254)^2(52)(0.32)]/5.6 = 1.4679465E07 \text{ barrels}$$

The volume currently available (V_2) takes into account the operating history of the well:

$$V_T - V_1 = V_2 = (1.4679465E07 - 1.0330390E07) = 4.349075E06 \text{ barrels}$$

The current maximum proposed injection rate (Q_2) is 1,800 BWPd, and using the above value for V_2 , the length of time remaining for injection operations (T_2) was determined to be

$$T_2 = V_2/365Q_2 = (4.349075E06)/(365)(1800) = 6.6 \text{ years} = 6 \text{ years}$$

The value for T_2 was rounded down to incorporate an additional margin of safety. The value of six (6) years is the length of time that Murphy Oil may continue to operate the Courchene No. 1-D. The reference date for the time limit to begin is January 1, 1987.

Finally, equation (6) can be used to determine the compatibility between the values of maximum allowable injection rate and proposed maximum injection pressure.

$$Q = (7.07kb[P_s - P_f])/m(\ln r_e/r_w) \quad (6)$$

Where

- Q = theoretical injection rate (BWPd)
- k = injection zone permeability in darcys (estimated as 0.045)
- b = thickness of injection zone in feet
- P_s = injection pressure at sand face (psig)
[750 psig + (0.037)(12)(1418) = 1380 psig]
- P_f = injection zone pore pressure (psig)
[(0.037)(12)(1418) = 630 psig]
- m = viscosity of water in centipoise = 0.4
- r_e = distance of 1/4-mile aquifer exemption, in feet
- r_w = well bore radius in feet

$$Q = ((7.07)(0.045)(52)[1380 - 630])/((0.4)[\ln (1320/0.333)]) = 3744 \text{ BWPd}$$

The maximum proposed injection rate is 1,800 BWPd, which is much lower than the theoretical value for rate. It is therefore concluded that the proposed rate is acceptable.

PART II, Section D MONITORING, RECORDKEEPING AND REPORTING OF RESULTS

Injection Well Monitoring Program (Condition 1)

The permittee is required to monitor water quality of the injected fluids at quarterly intervals during the first year of operation. This may be reduced to annual intervals after that time. A water sample of injected fluids shall be analyzed for total dissolved solids, pH, specific conductivity, and specific gravity. Anytime there is a change in the source of injection fluid, a new water quality analysis is also required.

PART II, Section E PLUGGING AND ABANDONMENT

Plugging and Abandonment Plan (Condition 2)

The plugging and abandonment plan submitted by the applicant (Appendix C) consists of one plug with the following specifications:

Fifty (50) sacks of cement will be placed within the 2-7/8 inch tubing at a depth of 1,441 feet, and the operator calculates that the top of cement will be at a depth of 6 feet.

PART II, Section F FINANCIAL RESPONSIBILITY

Demonstration of Financial Responsibility (Condition 1)

The permittee has chosen to demonstrate financial responsibility through a surety bond with an accompanying standby trust agreement. This type of coverage was reviewed and was determined to meet the financial criteria established by the EPA.